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EDITORIAL

LUNG REDUCTION SURGERY: A TRUE ADVANCE?

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A surgical approach to the treatment of patients with diffuse pulmonary emphysema was first reported by Brantigan, Mueller, and Kress[1] during the 1950s. They proposed that "reduction in lung volume by resection of the most useless and functionless areas of lung tissue" would improve lung function by partially restoring the "elasticity" of the lung and chest wall.[1] By 1959, Brantigan had performed lung reduction via sequential bilateral thoracotomies in 33 patients. Six patients (18%) died after the first operation, none died after the second operation, and all surviving patients were in improved condition symptomatically or objectively.[1] Brantigan's high operative mortality discouraged surgeons from operating on patients with diffuse emphysema until Cooper and his associates in St. Louis decided to explore lung reduction as an alternative to transplantation. Their initial report of bilateral pneumectomy via median sternotomy in 20 patients with no postoperative deaths and a definite early improvement in pulmonary function immediately stimulated other surgeons to explore the use of this surgical technique.[2]

In this issue of the JOURNAL, three groups report their experience with lung reduction surgery. Gaissert and coworkers,[3] from St. Louis, update their results with bilateral pneumectomy and assess its role as an alternative or bridge to transplantation. Keenan and colleagues,[4] at the University of Pittsburgh, report their early experience with unilateral thoracoscopic lung reduction, primarily using a stapled technique. McKenna and associates,[5] prompted by Wakabayashi's controversial experience with thoracoscopic laser bullectomy,[6] report the preliminary results of a randomized prospective trial comparing Wakabayashi's technique to unilateral thoracoscopic lung reduction with staples. Taken as a whole, these reports suggest that lung reduction surgery can now be performed with acceptable morbidity and mortality and may benefit a subset of patients with disabling chronic obstructive pulmonary disease. However, they raise as many questions as they answer, and they demand a sober evaluation of this innovative surgical treatment. Unanswered questions include the surgical selection criteria, the role of preoperative exercise conditioning, the degree to which lung reduction improves on exercise conditioning, the optimal surgical technique, the tests necessary to measure outcome, and the cost

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effectiveness of lung reduction surgery compared with continued medical management.

With respect to selection criteria, the members of the Washington University group believe they can identify the ideal candidate by the presence of severe thoracic hyperinflation, flattened diaphragm and immobile chest wall, and heterogeneous regions of disease on computed tomographic and ventilation/perfusion scans. They do not think that selection of the larger group of patients with less than ideal criteria is clear and are not yet able to define specific exclusion criteria. However, the Pittsburgh group found that the combination of hypercarbia and reduced diffusion of carbon monoxide in the lung identified patients with a serious postoperative risk. Currently, the preoperative evaluation of patients may include complete pulmonary function testing, exercise testing, computed tomographic and ventilation/perfusion lung scanning (sometimes with single photon emission computed tomographic imaging), dyspnea index measurement, and nutritional assessment, along with investigation of comorbid medical conditions as individually indicated. With thousands of dollars being spent to assess surgical eligibility, it will be important to define which tests are absolutely necessary because they clearly predict operative risk and outcome.

The Washington University group believes that a supervised pulmonary rehabilitation program is an integral part of perioperative care for lung reduction surgery, just as it has been for lung transplantation. In contrast, the Pittsburgh group encourages but does not require participation in a rehabilitation program, and McKenna and coworkers[5] used rehabilitation only in the postoperative period. Yet the hospital stay and morbidity are similar in all three studies. Does this similarity indicate that patients tolerate the smaller video-assisted thoracic surgery (VATS) incisions without preoperative conditioning, or does it reflect differences in patient selection? Can some patients undergo lung reduction surgery without a rehabilitation program? Do some patients benefit so much from rehabilitation that lung reduction can be deferred? A prospective trial randomizing patients to undergo or not undergo pulmonary rehabilitation or a trial withholding surgery until patients have reached a plateau in the rehabilitation program could answer these questions.

Many questions remain unanswered regarding surgical technique. The merits and disadvantages of median sternotomy for simultaneous bilateral pneumectomy versus those of VATS lung reduction (unilateral or sequential bilateral) are undefined. Can the areas of lung to be removed be defined as well thoracoscopically as at median sternotomy? Is the morbidity of VATS less? Is bovine pericardium reinforcement of staple lines, an expensive method, always necessary, or is endoscopic stapling in conjunction with pleurodesis just as effective? On the basis of limited data, many surgeons consider laser bullectomy unsafe. McKenna's results now confirm a higher rate of delayed pneumothorax after laser ablation and also show that it is less effective than stapling. His trial is the first to compare surgical techniques directly. More such trials are needed.

After patients leave the hospital, how much care and rehabilitation do they need? How many tests are required to assess outcome, and how frequently need they be performed? How does the cost of lung reduction surgery compare with that of continued medical management? McKenna's original abstract presented at the American Association for Thoracic Surgery meeting noted that hospital charges for VATS lung reduction were approximately $50,000. This cost does not include preoperative assessment, rehabilitation, and follow-up tests. Are the high immediate costs offset by the advantages—patients no longer requiring oxygen, decreasing their medications and hospitalizations for disease exacerbations, and being able to return to work? Are the promising initial results of lung reduction surgery sustained over the long term or do some patients experience inexorable disease progression?

With an estimated prevalence of 2 million cases of emphysema in the United States, the potential medical, social, and economic impact of lung reduction surgery is enormous. Evaluation of this new treatment through carefully designed prospective clinical trials is urgently needed. It is important that these trials ask focused questions in large enough numbers of patients observed for long enough periods (a minimum follow-up of 2 to 5 years) to yield definitive answers. Measurements of economic costs should be incorporated into these trials. In an era of shrinking health care dollars, premature reporting of the results of lung reduction surgery in small numbers of patients will only perpetuate the frequent perception of surgeons as specialists who strive to perform expensive and risky operations. In an era of shrinking resources for clinical research, institutions interested in lung reduction surgery might consider pooling their efforts to identify important questions, maximize patient accrual, and prevent repetitive or overlapping trials. In an era when many important research questions can be answered

only through complex basic science techniques or collaboration with other specialties, thoracic surgeons have an unusual opportunity to define the true benefit of a treatment that could affect the well-being of thousands of patients each year. We as thoracic surgeons should exploit that opportunity.

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